

**VASCULAR FLORA OF A LONGLEAF PINE UPLAND IN
SABINE COUNTY, TEXAS**

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ABSTRACT

We describe the vascular flora of select plots within longleaf pine uplands at Fox Hunter's Hill in the Sabine National Forest in eastern Texas. The eight established 0.1 ha plots contained a total of 196 species and averaged 87.25 species (range 71 to 112) per plot; sixteen 0.001 ha plots averaged 28.75 species (range 17 to 46); and sixteen 0.0001 ha plots averaged 12.44 species (range 5 to 25). A comparison between longleaf pine uplands in central Louisiana and Fox Hunter's Hill shows that they have similar floristic composition.

KEY WORDS: longleaf pine, *Pinus palustris*, longleaf pine uplands, Sabine National Forest, Sabine County, Texas.

Longleaf pine uplands are among the most extensively studied and best known ecosystems in the southeastern United States (Marks and Harcombe 1981, Platt et al. 1988, Frost 1993, Peet and Allard 1993, Ware et al. 1993, Streng et al. 1993, Glitzenstein et al. 1995, Noel et al. 1998, Platt 1999, Christensen 2000, Conner et al. 2001). Surprisingly, considering the amount of attention given to this ecosystem and its eponym, relatively little is known about the

herbaceous layer. Either little or no information has been collected or only partial descriptions are available. This is especially true of longleaf pine communities in the West Gulf Coastal Plain (Streng and Harcombe 1982, Bridges and Orzell 1989, Orzell 1990, Harcombe et al. 1993, MacRoberts and MacRoberts 1998, Turner et al. 1999, Haywood et al. 1998, 2001, Haywood and Harris 1999, Van Kley 1999a, 1999b, 2006, MacRoberts et al. 2004a, Lester et al. 2005, Diggs et al. 2006), where far less research has been done than in the Atlantic and East Gulf Coastal Plain (Peet and Allard 1993, Platt 1999, Christensen 2000). In our search of the literature, we were able to find only one detailed study of the floristic composition of longleaf pine uplands in the West Gulf Coastal Plain (MacRoberts et al. 2004a).

If management of longleaf pine communities is to be undertaken effectively, more than just eliminating offsite woody vegetation and reintroducing fire may be needed. At a minimum, the herbaceous layer must be known, for historical evidence indicates that many currently rare species were more common prior to recent anthropogenically influenced declines, and if current trends continue, today's common species may become rare in the near future (Glitzenstein et al. 2001). In order to reconstruct any plant community, whether by adding rare species to intact communities or by restoring badly degraded sites, one must know what was there initially and, while we cannot go back to pre-settlement vegetation, we can at least begin by studying or by documenting today's best managed sites.

Gathering information on the herbaceous layer of longleaf pine uplands is not always easy, since virtually all West Gulf Coastal Plain longleaf pine was cut during the last two centuries (Noss 1988, Frost 1993, Outcalt 1997, Platt 1999, Diggs et al. 2006). At best, second growth exists but even where there is second growth, there is seldom much, if any, herbaceous layer because of shading by shrub growth resulting from fire suppression (Platt et al. 1988, Streng et al. 1993, Olson and Platt 1995, Brewer 1998, Frost 1998, Platt 1999, Haywood et al. 1998, 2001, Drewa et al. 2002).

In pre-European North America, longleaf pine extended from Virginia to Texas (Schwarz 1907, Ware et al. 1993, Platt 1999, Conner et al. 2001). In the West Gulf Coastal Plain, it occurred in Louisiana

and Texas. In central and southwestern Louisiana and southeastern Texas there were large tracts of longleaf pine (Eldredge 1934, Smith 1991, Evans 1997, Outcalt 1997), which were cut in the late 19th and early 20th centuries. Over the total original range of longleaf pine, less than 3 percent remains in a semi-natural condition, and most of this is on public land (Frost 1993, Peet and Allard 1993, Bezanson 2000, Van Kley 2006).

Information about longleaf pine uplands before the arrival of Europeans can be gleaned from historical descriptions, lumber company records, and from the few acres that have miraculously survived logging, for example, the Wade Tract in Georgia (Evans 1997, Platt 1999). Early travelers write of monospecific longleaf pine uplands in central Louisiana and eastern Texas (MacRoberts et al. 2004a, Diggs et al. 2006). They depict a landscape with widely spaced uneven aged pines, an open canopy with frequent gaps, and a rich herbaceous layer of grasses, composites, and other forbs. There was little or no midstory and little or no woody vegetation. Every one to three years low intensity fires moved through these pinelands, usually in the spring and summer.

Since documentation of floristic composition can be found only for a small portion of this community --- notably lacking is documentation for the herbaceous layer --- it was the purpose of this study to locate a longleaf pine upland where the understory appeared to be intact and to obtain a floristic list. While the aim was to gather baseline data, the question of the quality of longleaf pine uplands in the West Gulf Coastal Plain is also briefly addressed (see Conner et al. 2001 for detailed discussion).

STUDY SITE

Previous surveys of the Texas National Forests and Grasslands in Texas, notably the Sabine National Forest and Angelina National Forest, have pinpointed several high quality longleaf pine uplands (Orzell 1990). One of these is Fox Hunter's Hill in southern Sabine County, Texas.

Fox Hunter's Hill is situated in the Mayflower Uplands Landtype Association (LTA). This LTA is associated with the Catahoula formation overlain with sandstones, sandy clays, and volcanic tuffs. Clay outcrops are present as are deep sands and loams. The topography is generally a rolling hill landscape with some steep hills. The LTA is noted for the longleaf-little bluestem herbaceous community, Catahoula barrens (glades), and hillside seeps/bogs (Figure 1).

However, Fox Hunter's Hill, like the remainder of longleaf pine uplands in the West Gulf Coastal Plain, is not pristine. Pine stands are generally young, over-stocked, and even-aged; the canopy is dense, with insufficient gaps, and there is often too much shrub and mid-story woody vegetation. Forest Service records indicate that prescribed fire has been introduced mainly in the non-growing season (however, recent

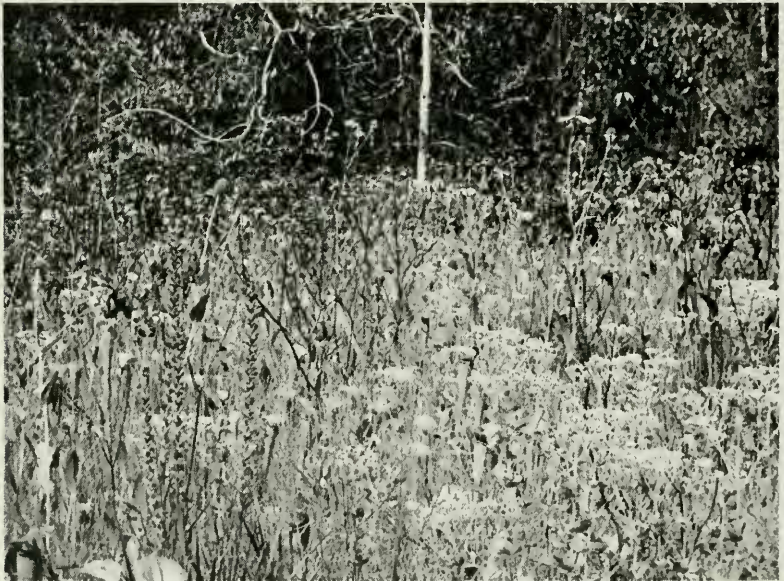


Figure 1. Shingle Branch Bog occurs within Fox Hunter's Hill

burns have been applied as late as May) and often with long intervals (2-4 years) between ignitions. In spite of these problems, Fox Hunter's Hill (Figure 2) has a diverse ground layer in many places.

Community types at Fox Hunter's Hill include extensive areas of arenic dry uplands, loamy dry mesic uplands, and small patches of xeric sandylands and glades. Along creeks are herbaceous seeps, particularly bogs and baygalls (Orzell 1990, Diggs et al. 2006, Van Kley 2006). High-quality longleaf pine upland is habitat for such



Figure 2. Upland Longleaf Community at Fox Hunter's Hill

federally listed animals as the Red-cockaded Woodpecker and the Louisiana Pine Snake (Connor et al. 2001), and rare plants such as *Liatris tenuis* Shinnery (Figure 3), *Silene subciliata* B.L. Robins., and *Rudbeckia scabrifolia* L. Brown (Carr 2004).

Few logging and other silvicultural activities have been conducted at Fox Hunter's Hill in the recent past. In the past 17 years, two prescriptions have been written for the area (S. Walker unpubl. data); however, one of the projects was not carried out and the other project included only a small area of patch clear-cut that was necessary due to scorch from a prescribed burn. That area was replanted with longleaf pine. Prescribed fire has been the main management tool used in Fox Hunter's Hill for the past 15 years. With the exception of 2000-



Figure 3. *Liatris tenuis* Shinnery

2003, when no prescribed burning occurred, Fox Hunter's Hill has been burned on a 2-3 year rotation (T. Zimmerman pers. comm.). The timing of burns alternated between fall and late winter to early spring. However, the latest prescribed burn applied to Fox Hunter's Hill occurred in May 2006 because of a desire to implement a growing season fire pattern.

METHODS

We established eight 20 m x 50 m (0.1 ha) plots in areas representative of the various longleaf pine upland habitats (Figure 4). Included were extensive areas of arenic dry uplands and loamy dry mesic uplands. Plots 1, 3, and 5 were mostly herbaceous and plots 2, 4, 6, and 8 were mostly shrubby. Plot 6 contained a small area of xeric sandylands; plots 3 and 7 had Catahoula glade elements. Within each 0.1 ha plot, we established two nested 3.16 m x 3.16 m (0.001 ha) plots

and two 1 m x 1 m nested (0.0001 ha) plots (see Peet et al. [1998] for plot design). We surveyed these plots on 21 and 22 June 2005, 12 July 2005, 26 and 27 October 2005, and 5 and 6 April 2006, and recorded all species in each. We estimated canopy cover for each 0.1 ha plot.

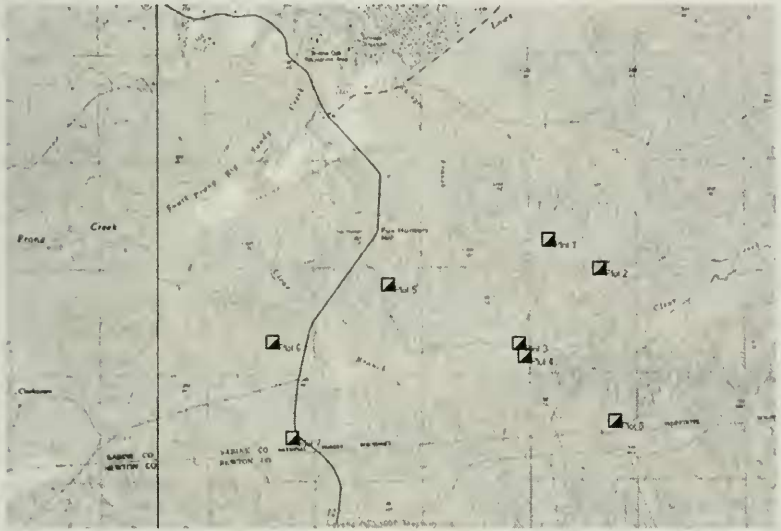


Figure 4. Plot locations at Fox Hunter's Hill

Throughout this paper, plant nomenclature follows Kartesz and Meacham (1999), Diggs et al. (2006), or USDA (2006).

RESULTS

Table 1 lists the vascular flora of the eight 0.1 ha plots. 1-8 refer to the 0.1 ha plot in which the species occurred.

Table 1: Fox Hunter's Hill Plant Species List 2005-2006

ACANTHACEAE

Ruellia humilis Nutt. (1)(2)(4)(5)(6)

ACERACEAE

Acer rubrum L. (1)(2)(4)

AGAVACEAE

Yucca louisianensis Trel. (2)(8)

ANACARDIACEAE

Rhus copallinum L. (1)(2)(4)(5)(6)(8)

Toxicodenron pubescens P. Mill. (1)(2)(3)(4)(5)(6)(7)(8)

ANNONACEAE

Asimina parviflora (Michx.) Dunal (1)(2)(5)(6)

APIACEAE

Eryngium yuccifolium Michx. (1)(5)(6)(7)

AQUIFOLIACEAE

Ilex opaca Ait. (2)(6)(8)

Ilex vomitoria Ait. (1)(2)(3)(4)(5)(6)(8)

ARISTOLOCHIACEAE

Aristolochia reticulata Jacq. (1)(2)(3)(5)(6)

Aristolochia serpentaria L. (1)(4)(5)

ASCLEPIADACEAE

Asclepias amplexicaulis Sm. (6)

Matelea cynanchoides (Engelm.) Woods. (6)

ASTERACEAE

Ambrosia artemisifolia L. (1)(2)(5)(8)

Baccharis halimifolia L. (1)(5)

Berlandiera pumila (Michx.) Nutt. (1)(2)(5)(6)

Bigelowia nuttallii L.C. Anders. (3)(4)

Boltonia diffusa Ell. (2)(4)

Chrysopsis pilosa Nutt. (1)(3)(4)(5)(6)(7)(8)

Cirsium sp. (6)

Croptilon divaricatum (Nutt.) Raf. (6)

Echinacea pallida (Nutt.) Nutt (7)

Elephantopus tomentosus L. (4)

- Erigeron strigosus* Muhl. ex Willd. (1)(6)(8)
Eupatorium capillifolium (Lam.) Small (5)(6)
Eupatorium compositifolium Walt. (1)(2)(5)(6)
Eupatorium rotundifolium L. (1)(2)(3)(4)(5)(6)
Eurybia hemisphaerica (Alex.) Nesom (7)
Gaillardia aestivalis (Walt.) H. Rock (1)(5)(6)
Helianthus angustifolius L. (1)(2)(3)(4)(5)(7)(8)
Helianthus hirsutus Raf. (4)
Hieracium gronovii L. (1)(2)(3)(4)(5)(6)(7)(8)
Hymenopappus artemisiifolius var. *artemisiifolus* DC. (1)(2)(5)(6)
Ionactis linariifolius (L.) Greene (1)(3)(4)(5)(6)(7)
Krigia sp. (6)
Lactuca canadensis L. (1)(2)(5)
Liatris elegans (Walt.) Michx. (1)(2)(5)(6)(8)
Liatris pycnostachya Michx. (6)
Liatris squarrosa (L.) Michx. (4)(5)(8)
Liatris tenuis Shinnars (3)(4)(7)
Pityopsis graminifolia (Michx.) Nutt. var. *graminifolia*
 (1)(2)(3)(4)(5)(6)(7)(8)
Pseudognaphalium obtusifolium (L.) Hilliard & Burt (5)(6)
Rudbeckia grandiflora (D. Don) J.F. Gmel ex DC. (1)
Rudbeckia hirta L. (1)(2)(3)(4)(5)(6)(7)(8)
Silphium gracile Gray (1)(2)(5)(6)
Solidago nitida Torr. & A. Gray (1)(2)(6)(7)
Solidago odora Ait. (1)(2)(3)(4)(5)(6)(7)(8)
Solidago petiolaris Ait. (2)(3)(5)(8)
Symphyotrichum dumosus (L.) Nesom (3)(4)(6)(7)
Symphyotrichum patens (Ait.) Nesom var. *patens* (1)(2)(3)(6)(7)(8)
Symphyotrichum pratensis (Raf.) Nesom (3)(4)(7)
Vernonia texana (A. Gray) Small (1)(2)(3)(4)(6)(7)(8)

BIGNONIACEAE

- Bignonia capreolata* L. (1)(7)

BORAGINACEAE

- Lithospermum caroliniense* (Gmel.) MacM. (1)(2)(5)(6)

CAMPANULACEAE

- Lobelia appendiculata* A. DC. (6)

Lobelia puberula Michx. (1)(2)(3)(4)(5)(6)

CAPRIFOLIACEAE

Viburnum rufidulum Raf. (8)

CISTACEAE

Helianthemum georgianum Chapm. (1)(6)

Lechea mucronata Raf. (1)(3)(4)(5)(7)

Lechea tenuifolia Michx. (3)(5)

CLUSIACEAE

Hypericum crux-andreae (L.) Crantz (3)(4)

Hypericum gentianoides (L.) B.S.P. (3)(6)(7)

Hypericum hypericoides (L.) Crantz (1)(3)(4)(5)(6)(7)(8)

COMMELINACEAE

Commelina erecta L. (1)(2)(5)(6)

Tradescantia reverchonii Bush (1)(5)(6)

CONVOLVULACEAE

Ipomoea pandurata (L.) G.F.W. Mey. (5)

CORNACEAE

Cornus florida L. (1)(2)(4)(5)(6)(8)

Nyssa sylvatica Marsh. (2)(3)(4)(5)(7)(8)

CYPERACEAE

Carex caroliniana Schwein. (4)

Cyperus echinatus (L.) Wood (1)(2)(5)(6)(8)

Cyperus filiculmis Vahl. (6)

Cyperus retrofractus (L.) Torr. (5)

Rhynchospora globularis (Chapm.) Small. (3)(4)(7)(8)

Rhynchospora grayi Kunth (1)(2)(3)(4)(8)

Scleria ciliata Michx. (2)(3)(4)(5)(6)(8)

Scleria oligantha Michx. (8)

Scleria triglomerata Michx. (1)(5)(6)

DENNSTAEDTIACEAE

Pteridium aquilinum L. (1)(7)(8)

DROSERACEAE

Drosera brevifolia Pursh (3)(4)(7)(8)

EBENACEAE

Diospyros virginiana L. (4)(7)

ERICACEAE

Vaccinium arboreum Marsh. (1)(2)(3)(4)(5)(7)(8)

Vaccinium corymbosum L. (1)(2)(3)(4)(6)(7)(8)

Vaccinium stamineum L. (1)(2)(3)(4)(5)(7)(8)

EUPHORBIACEAE

Acalypha virginica L. (5)(6)

Cnidocolus texanus (Muell.-Arg.) Small (5)(6)

Croton argyranthemus Michx. (1)(3)(4)(5)(6)

Croton willdenowii G.L. Webster (3)(6)

Croton michauxii G.L. Webster (7)

Euphorbia sp. (8)

Euphorbia corollata L. (1)(2)(3)(4)(6)(7)(8)

Stillingia sylvatica L. (2)(5)(6)(8)

Tragia smallii Shinnery (1)(2)(5)(6)(8)

Tragia urens L. (1)(2)(5)(6)(8)

Tragia urticifolia Michx. (1)(2)(5)(6)(8)

FABACEAE

Baptisia bracteata Muhl. ex Ell. var. *laevicaulis* (Gray ex Canby) Isely (1)(3)(4)(6)

Centrosema virginiana (L.) Benth. (2)(5)(6)

Chamaecrista fasciculata (Michx.) Greene var. *fasciculata* (1)(3)(5)

Clitoria mariana L. (5)

Crotalaria sagittalis L. (1)(5)(6)

Desmodium sessilifolium (Torr.) T.&G. (2)(3)(4)(5)(6)(7)(8)

Desmodium ciliare (Muhl. ex Willd.) DC. (1)

Erythrina herbacea L. (6)

Galactia volubilis (L.) Britt. (1)(2)(3)(5)(6)(7)(8)

Lespedeza sp. (5)(6)

Lespedeza procumbens Michx. (3)

Lespedeza repens (L.) Barton (7)

- Lespedeza virginica* (L.) Britt. (3)
Mimosa hystricina (Small) B.L. Turner (5)(7)
Rhynchosia latifolia Nutt. ex. Torr. & Gray (1)(6)
Rhynchosia reniformis DC. (1)(2)(3)(5)(6)
Strophostyles umbellata (Muhl. ex Willd.) Britt. (1)(2)(3)(5)(6)
Stylosanthes biflora (L.) B.S.P. (3)(4)(5)(6)(7)(8)
Tephrosia onobrychoides Nutt. (1)(2)(3)(4)(5)(6)(7)
Tephrosia virginiana (L.) Pers. (1)(2)(3)(4)(5)(6)(7)(8)

FAGACEAE

- Quercus alba* L. (3)(4)(8)
Quercus falcata Michx. (1)(2)(3)(6)(7)(8)
Quercus incana Bartr. (2)(5)(6)
Quercus marilandica Muenchh. (1)(3)(4)(6)(7)(8)
Quercus nigra L. (2)(8)
Quercus stellata Wang. (3)(4)(7)(8)

GENTIANACEAE

- Sabatia campestris* Nutt. (6)

HAMAMELIDCEAE

- Liquidambar styraciflua* L. (2)(3)(4)(5)(6)(7)(8)

IRIDACEAE

- Alophia drummondii* (Graham) Foster (1)(5)(6)(8)
Sisyrinchium albidum Raf. (3)(4)(7)(8)

JUGLANDACEAE

- Carya alba* (L.) Nutt. ex Ell. (6)
Carya texana Buckl. (1)(2)(6)(8)

LAMIACEAE

- Monarda fistulosa* L. (6)
Pycnanthemum albescens Torr. & A. Gray (4)(5)(6)
Salvia azurea Michx. ex Lam (8)
Scutellaria sp. (3)
Scutellaria cardiophylla Engelm. & A. Gray (6)(8)
Scutellaria parvula Michx. (3)

LAURACEAE

Persea palustris (Raf.) Sarg. (1)(2)(6)(8)

Sassafras albidum (Nutt.) Nees (1)(2)(5)(6)(7)

LILIACEAE

Allium canadense L. (4)

Hypoxis hirsuta (L.) Coville (5)

Nothoscordum bivalve (L.) Britt. (3)(4)(7)

LINACEAE

Linum medium (Planch.) Britt. (1)(3)(4)(5)

LOGANACEAE

Gelsemium sempervirens (L.) Ait. f. (1)(2)(3)(4)(5)(6)(7)(8)

MAGNOLIACEAE

Magnolia grandiflora L. (6)

Magnolia virginiana L. (1)

MYRICACEAE

Morella cerifera (L.) Small (1)(2)(3)(5)(7)(8)

OLEACEAE

Chionanthus virginicus L. (4)(7)(8)

OXALIDACEAE

Oxalis dillenii Jacq. (1)(2)(6)(7)

Oxalis violacea L. (1)

PASSIFLORACEAE

Passiflora lutea L. (2)

PINACEAE

Pinus echinata P.Mill. (1)(2)(3)(4)(6)(7)(8)

Pinus palustris P.Mill. (1)(2)(3)(4)(5)(6)(7)(8)

Pinus taeda L. (1)(2)(5)(6)(7)(8)

POACEAE

Agrostis sp. (1)(2)

- Andropogon gerardii* Vitman (2)(3)(6)(7)
Andropogon ternarius Michx. (1)(2)(6)(7)
Andropogon virginicus var. *virginicus* L. (1)(6)(7)
Aristida lanosa Muhl. ex Ell. (1)(3)(6)
Aristida longespica Poir (1)(2)(3)(6)(7)
Chasmanthium laxum (L.) Yates (4)(6)
Coelorachis cylindrica (Michx.) Nash (1)(5)(6)(8)
Dichantherium aciculare (Desv. ex Poir) Gould & Clark (3)(4)(5)(6)(7)
Dichantherium acuminatum (Sw.) Gould & C.A. Clark (1)(2)(4)(5)(8)
Dichantherium oligosanthes (J.A. Schultes) Gould (1)(6)
Dichantherium scoparium (Lam.) Gould (2)(3)
Dichantherium sphaerocarpon (Ell.) Gould (1)(3)(4)(5)(6)(8)
Digitaria cognata (J.A. Schult.) Pilger (8)
Eragrostis spectabilis (Pursh) Steud. (2)(4)(7)
Gymnopogon ambiguus (Michx.) B.S.P. (1)(2)(5)(6)
Panicum sp. (8)
Panicum anceps Michx. (4)
Paspalum floridanum Michx. (3)(4)(7)
Paspalum setaceum Michx. (2)(5)
Schizachyrium scoparium (Michx.) Nash (1)(2)(3)(4)(5)(6)(7)(8)
Sorghastrum elliottii (C. Mohr) Nash (3)(6)
Sporobolus junceus (Beauv.) Kunth (1)(2)(6)(8)
Tripsacum dactyloides (L.) L. (5)

POLEMONIACEAE

- Phlox pilosa* L. (1)(2)(3)(5)

POLYGALACEAE

- Polygala mariana* Mill. (3)
Polygala nana (Michx.) DC. (2)(3)(5)
Polygala polygama Walt. (8)

RANUNCULACEAE

- Delphinium carolinianum* subsp. *vimineum* (D. Don) Warnock (5)(6)

RHAMNACEAE

- Berchemia scandens* (Hill) K. Koch (4)
Ceanothus americanus L. (2)(3)(5)
Frangula caroliniana (Walt.) A. Gray (8)

ROSACEAE

- Crataegus brachyacantha* Sarg. & Engelm. (3)
Crataegus marshallii Egglest. (2)(3)(4)(7)(8)
Crataegus spathulata Michx. (4)(7)
Rubus argutus Link (2)(3)(4)(6)(7)(8)

RUBIACEAE

- Diodia teres* Walt. (3)(6)
Galium pilosum Ait. (1)(2)(3)(5)(6)
Hedyotis nigricans (Lam.) Fosberg (1)(2)(5)(6)
Houstonia micrantha (Shinners) Terrell (4)
Mitchella repens L. (4)(8)

SAPOTACEAE

- Sideroxylon lanuginosum* Michx. (2)

SCROPHULARIACEAE

- Agalinis homalantha* Pennell (4)(6)(7)(8)
Penstemon laxiflorus Pennell (4)(5)(8)

SMILACACEAE

- Smilax bona-nox* L. (2)(4)(7)
Smilax glauca Walt. (2)(3)(4)(6)(8)
Smilax rotundifolia L. (4)(7)
Smilax smallii Morong (4)(7)(8)

SOLANACEAE

- Physalis pumilla* Nutt. (1)(6)

SYMPLOCACEAE

- Symplocos tinctoria* (L.) L'Her. (8)

VERBENACEAE

- Callicarpa americana* L. (1)(2)(3)(4)(5)(6)(8)
Glandularia canadensis (L.) Nutt. (1)(2)

VIOLACEAE

- Viola pedata* L. (3)(4)(7)(8)

VITACEAE

Parthenocissus quinquefolia (L.) Planch. (1)(3)*Vitis aestivalis* Michx.(1)(2)(3)(5)(6)(8)*Vitis rotundifolia* Michx.(1)(2)(4)(6)

Table 2 gives information on species richness in the 0.1 ha, 0.001 ha, and 0.0001 ha plots.

Table 2. Number of species in plots

Plot No.	0.1 ha plot	Nested plots within 0.1 plots			
		0.001 ha plots		0.0001 ha plots	
		average	range	average	range
1	96	32.5	27-38	12.5	8-17
2	88	25.5	25-26	7.0	5-9
3	83	24.0	20-28	9.0	7-11
4	80	22.0	17-27	11.5	9-14
5	93	31.5	28-35	17.5	15-20
6	112	45.5	45-46	24.5	24-25
7	71	23.0	21-25	7.0	5-9
8	75	26.0	21-31	10.5	9-12

Canopy cover of the eight 0.1 plots were as follows: plot 7 (20 percent); plot 3 (40 percent); plots 1, 2, 4, 5, 6 (50 percent); plot 8 (70 percent). The average was 48 percent.

DISCUSSION

The eight 0.1 ha plots had 196 species and averaged 87.25 species (range 71 to 112); while the sixteen 0.001 ha plots averaged 28.75 species (range 17 to 46); and the sixteen 0.0001 ha plots averaged 12.44 species (range 5 to 25).

MacRoberts et al. (2004a) provide the most complete West Gulf Coastal Plain longleaf pine uplands data set for comparison with the Fox Hunter's Hill plots. They established four 0.1 ha plots in

longleaf pine uplands (arenic dry uplands) in the Winn and Catahoula ranger districts of the Kisatchie National Forest, Louisiana, about 150 km northeast of Fox Hunter's Hill, and recorded all species in them. Their plots had between 82 and 113 species (average 100). An Index of Similarity (Sorenson's) between the eight 0.1 ha plots at Fox Hunter's Hill and the four 0.1 ha plots Kisatchie National Forest gives a figure of 63, a relative high degree of similarity. This degree of similarity is interesting considering the small amount of area sampled in both studies (0.8 ha at Fox Hunter's Hill, 0.4 ha at Kisatchie), unequal sample size (196 species at Fox Hunter's Hill, 158 species at Kisatchie), the distance between study sites (150 km), and the fact that Fox Hunter's Hill included plots with dryer (xeric) and wetter (loamy dry-mesic uplands) elements than the Kisatchie sample (arenic dry uplands only). This suggests that longleaf pine uplands in the West Gulf Coastal Plain may be very similar floristically over their range.

Data on species richness in the West Gulf Coastal Plain are scanty. Open habitat such as bogs, prairies, xeric sandylands, and old fields average about 15-25 species in 0.0001 ha plots, 30-40 in 0.001 ha plots, and 75-120 in 0.1 ha plots (MacRoberts and MacRoberts 2001, MacRoberts et al. 2002). In closed (shaded) habitat, the numbers drop dramatically (Brewer 1998, MacRoberts et al. 2004b, MacRoberts unpublished data). The data for Fox Hunter's Hill are therefore encouraging, with averages of 12.44, 28.75, and 87.25 for 0.0001 ha, 0.001 ha, and 0.1 ha plots.

Recommendations for the future management of Fox Hunter's Hill would include more frequent fire mainly in the growing season, lower stocking in many places, the creation of gaps so that natural regeneration will occur, and the creation of an uneven distribution of pines.

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